UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

UNDERGROUND INJECTION CONTROL AQUIFER EXEMPTION

FOR

California Division of Oil, Gas, and Geothermal Resources
Class II Injection Operations

In compliance with provisions of the Safe Drinking Water Act, as amended, (42 USC 300f-300j-9) and attendant regulations incorporated by the U.S. Environmental Protection Agency under Title 40 of the Code of Federal Regulations, the zone described as follows:

(1) the Aurignac and Continental geologic strata which occur at this location within the subsurface interval of approximately 2,740 feet to 5,420 feet below ground surface (bgs); and

(2) laterally within the following sections of Township 23 South, Range 11 East, Monterey County, California:
Sections 14 (western half),15, 16, 17 (eastern half), 19, 20, 21, 28, 29, 30, 31, 32, and 33, and

(3) laterally within the northern halves of sections 4 and 5 of Township 24 South, Range 11 East, Monterey County, California.

is exempted as an underground source of drinking water (USDW).

This aquifer exemption is granted in conjunction with the Class II Underground Injection Control permit issued to AERA Energy LLC.

This aquifer exemption has no expiration date.

Signed this 12 day of July, 1999.

Alexis Strauss, Acting Director
for Water Division, EPA Region 9

PUBLIC NOTICE OF INTENT TO ISSUE AN
UNDERGROUND INJECTION CONTROL (UIC) AQUIFER EXEMPTION

Purpose of Public Notice

The U.S. Environmental Protection Agency (EPA) is soliciting public comments on its proposal to issue an UIC Aquifer Exemption for California Division of Oil, Gas, and Geothermal Resources (CDOGGR) Class II Injection Operations. This Aquifer Exemption is proposed in conjunction with the public comment period for a Class II UIC permit issued to AERA Energy LLC by the CDOGGR.

The zone that EPA is proposing to exempt as an underground source of drinking water (USDW) is described as follows:

(1) the Aurignac and Continental geologic strata which occur at this location within the subsurface interval of approximately 2,740 feet to 5,420 feet below ground surface; and

(2) laterally within the following sections of Township 23 South, Range 11 East, Monterey County, California:

Sections 14 (western half),15, 16, 17 (eastern half), 19, 20, 21, 28, 29, 30, 31, 32, and 33, and

(3) laterally within the northern halves of sections 4 and 5 of Township 24 South, Range 11 East, Monterey County, California.

Background

The EPA has reviewed a request from the CDOGGR for aquifer exemption of the above referenced zone. In concurrence with the CDOGGR, the EPA has determined that the Aurignac and Continental sands (the zone) meets the criteria for aquifer exemptions pursuant to 40 CFR §146.4, because:

- The zone does not currently serve as a source of drinking water; and
- The total dissolved solids content of the water within the zone is more than 3,000 milligrams per liter (mg/l) and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.
- The zone cannot now and will not in the future serve as a source of drinking water because it is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical.

Therefore, the EPA has made a preliminary determination to approve the request.

Public Comments

Public comments will be accepted, in writing, at the CDOGGR District 3 office in Santa Maria to Mr. Al Kohler; 5075 South Bradley Road, Suite 221; Santa Maria, CA 93455-5077 during the thirty (30) day comment period. A request for a public hearing must be made in writing and should state the nature of any issues to be proposed for discussion at the hearing. A PUBLIC HEARING WILL BE HELD ONLY IF SIGNIFICANT INTEREST IS SHOWN.

Requests for Additional Information

Requests for further information may be directed to Mr. Al Kohler, CDOGGR District 3; 5075 South Bradley Road, Suite 221; Santa Maria, CA 93455-5077; phone (805) 937-7246; or to Mr. George Robin, U.S.E.P.A. Region 9; 75 Hawthorne St. WTR-9; San Francisco, CA 94105; phone (415) 744-1819.

Final Decision and Appeal Process

A final decision to issue, modify, or deny the aquifer exemption will be made after all comments have been reviewed. Notice of the decision will then be sent to each person who has either requested such notice or has submitted written comments.

If issued, the aquifer exemption shall become effective immediately, provided that there were no comments requesting a substantial change to the final decision. If substantial changes were requested or were incorporated into the final aquifer exemption, the final aquifer exemption will become effective thirty (30) days after issuance.

Within those thirty (30) days from the date of issuance (before the final aquifer exemption becomes effective), any person who filed comments, participated in a public hearing, or took issue with any changes to the aquifer exemption may petition the Director to review the decision. Persons interested in appealing the final aquifer exemption decision should refer to 40 CFR §§ 124.15 and 124.20 for the procedural requirements of the appeal process.

AERA

April 13, 1999

George: also by email

VIA AIRBORNE EXPRESS

Mr. Gregg Olson (WTR-9)
U.S. E.P.A.
75 Hawthorne Street
San Francisco, CA 94105

Dear Mr. Olson:

SUBJECT: REQUEST FOR EXPANDED AQUIFER EXEMPTION - SAN ARDO OIL FIELD

Enclosed please find an "Engineering and Geology Report" in support of the request made by Aera Energy LLC (Aera) to expand the existing aquifer exemption in the San Ardo Oil Field.

By way of introduction, Aera is California's largest producer of oil and gas and we are also the largest producer in the San Ardo Field.

Thank you for your cooperation in this project. Please call me at (661) 326-5641 if you have any questions regarding this exemption request.

Sincerely,

Ron Chambers

R. L. Chambers
Lead Environment, Health & Safety Advisor
Waste, Water, Remediations

RLC:gem

Enclosure

R:\EHS\WWR\RC910302.DOC

APPLICATION FOR AQUIFER EXEMPTION
NON-HYDROCARBON PRODUCING ZONES – DISTRICT 3

1. FIELD	San Ardo
2. ZONES	Aurignac and Continental
3. DEPTH TO TOP OF ZONES	2740' (Aurignac) 3170' (Continental)
4. THICKNESS	300-900 (Aurignac) 0-2250 (Continental)
5. Areal Extent	Listed are all sections we have a lease on in the area. T23S R11E: Portions of Sections 14 ,15 and 33, all of sections 16,17,19,20,21,28,29,30,31,32. T24S R11E : Portions of Sections 4 and 5
6. TDS of Zone	8000 mg/l (measured) in Aurignac. Continental not yet tested.
7. TDS of Injection Fluid	Approximately 8000 mg/l
8. Are Injection Fluids other than produced water proposed?	Yes,
Additional Class II Fluids Include:	Regeneration Brines Cogeneration Wastewater SO_2 Scrubber Blowdown
9. Miscellaneous Information	Both zones are hydrocarbon bearing but are not commercial.
10. Drinking Water Declaration	Aurignac and Continental are not sources per Mr. Matt Fore (Monterey County Environmental Health Department)
11. Distance to Towns	Bradley is 2 ½ miles south (population < 100) San Ardo is 7 miles northwest (population < 500).
12. Land Use	Agricultural / Cattle Grazing
13. Alternate Water Source	Salinas River / Stormwater
14. Unusual Geology	None

DATA REQUIRED FOR WATER INJECTION PROJECT
CALIFORNIA DIVISION OF OIL AND GAS

Aera Energy LLC
Orradre Lease , Aurignac and Continental Sands
Sections 30 and 33, T 23S , R 11E, M.D. B&M
San Ardo Field, Monterey County , California

A) ENGINEERING STUDY :

1) Statement of Primary Purpose of Project
The primary purpose of this project will be to dispose of produced water from Aera's San Ardo operation into the Aurignac sand of the Orradre Lease in Section 30 and into both the Aurignac and Continental sands in Section 33 of T23S, R11E M.D. B&M. A location map of the project area follows as Exhibit A1.1.

2) Reservoir Characteristics of the Aurignac and Continental Sands
The upper zone that will be injected into will be the Aurignac sand, which has the following reservoir characteristics in the Southeast Waste Water Disposal Project area:

AURIGNAC

Porosity	- 18-32 %
Permeability	- 5-16000 md
Average Thickness (net pay)	- 280 ft
Aerial Extension	- ~ 8500 acre
Fracture Gradient (Hambey 801-17)	- 0.9 psi/ft
Formation Temperature	
Original	- 128^0 F
Current	- 128^0 F
Formation Pressure	- 798 psi @ 2760 ft
Oil Saturation	
Original	- 0 - 10%
Current	- 0 - 10%
Water Saturation (Original)	- 90 - 100.0%

The lower zone of injection will be the Continental sand, with the following reservoir characteristics in the project area:

CONTINENTAL

Porosity	- 12-33 %
Permeability	- 10-70 md
Average Thickness (net pay)	- 200 ft
Aerial Extension	- ~8000 acre

Fracture Gradient	- N/A
Formation Temperature	
Original	- 152° F
Current	- 152° F
Formation Pressure	- 1500 psi @ 3893 ft
Oil Saturation	
Original	- 0 - 10 %
Current	- 0 - 10 %
Water Saturation (Original)	- 90 - 100 %

3) Reservoir Fluid Data From Injection Zone
A reservoir fluid sample analysis was taken from the Aurignac reservoir in Well Orradre 811-30 and is attached as Exhibit A3.1. (A water sample from the Continental zone is not available as the zone has not yet been tested) Both zones are water saturated but contain oil shows in the project area, with critical parameters from the Aurignac as follows:

Oil Gravity	- N/A
Oil Viscosity	- N/A
Water Salinity	- 100% Reacting
Water Quality (TDS)	- 8000
Specific Gravity @ 60° F	- 1.006

4) Wellbore Integrity Data in the Radius of Review
There are NO wells within one quarter mile of the Orradre Project area. Two of the nearest wells are each approximately one mile NE and SE from 811-30 while one well is a half mile NE of 831-33. Wellbore sketches of Orradre 811-30 and Orradre 831-33 are included as Exhibits A4.1 and A4.2. Wellbore sketches of future project wells will be forwarded as the wells are completed.

5) Planned Drilling and Abandonment Program
Current plans for the Orradre area water disposal project includes existing vertical wells Orradre 811-30 (drilled in June 1997) and Orradre 831-33 (October 1997). Two additional wells (both horizontal) will be drilled from the present surface location of 811-30 during the second quarter of 1999. Exhibit A5.1 indicates approximate proposed bottomhole locations for these wells. Additional development of the area (Section 33) will be dependent upon production trends in Aera's San Ardo Unit.

B) GEOLOGIC STUDY

1) Structural Contour Map of the Top of the Injection Zones
Structural contour maps of the top of the Aurignac zone and the top of the Continental zone in the Orradre area are attached as Exhibits B1.1 and B1.2.

2) Isopachous Map of the Injection Zones
Isopachous maps of gross pay for the Aurignac and Continental zones of the Orradre area are attached as Exhibits B2.1 and B2.2.

3) Geologic Cross Section of the Injection Zones
Geologic cross sections including the Aurignac zone and the Continental zone in the Orradre area are attached as Exhibits B3.2 . (Cross-Section Index is Exhibit B3.1) Electric logs in general demonstrate that there is over 1300 ft of overburden between injection zone and the fresh water zone, including three underpressured exempt reservoirs; the Lombardi, the "D" and "E" sands and the Santa Margarita as well as multiple competent shale barriers.

4) Representative Electric Log of all Geologic Units
In addition to the electric logs presented in the Aurignac zone cross section (Exhibit B3.2), a type log demonstrating the geologic units of interest in the San Ardo field is attached as Exhibit B4.1.

C) INJECTION PLAN

1) Map Showing Injection Facilities
Included as Attachment C1.1 is a map showing the location of the Central Water plant where the main injection pumps are located. The map also shows the routing of the water transport pipeline, the preliminary sizing and tentative timing plans for installation.

2) Maximum Anticipated Surface Pressure and Rate by Well
An injection/fall off test was performed on Orradre 811-30 during the months of August and September 1997. Said test was approved by the D.O.G.G.R on April 2, 1997. Injectivity into the Aurignac zone is very good and similar to testing done on Hambey 801-17 in 1990, in the San Ardo Field. A second well Orradre 831-33 was drilled, logged, "Repeat Formation Tested" and sidewall cored in both the Aurignac and Continental Zones. Basic reservoir parameters are similar to the 811-30 Aurignac. No formal injectivity test has as yet been performed on the second well.
A hydrostatic gradient of 0.4356 psi/ft for injection fluid with a specific gravity of 1.006, subtracted from the injection pressure gradient of 0.7 psi/ft (D.O.G.G.R. approved injection gradient for Hambey Aurignac Project dated July 27, 1990 is 0.8psi/ft) provides a well head fluid injection gradient of 0.2644 psi/ft before friction loss in the Orradre Area. For Orradre 811-30, top perf at 2750', this equates to a MASP of 727 psi before friction loss. A curve demonstrating the Orradre 811-30 MASP including friction loss as a function of injection rate is

included as Exhibit C2.1. Injection pressures will never exceed the rate dependent MASP's on this curve. The current estimated rate for Orradre 811-30 is 21000 BWPD, indicating the MASP will typically be 800 psi. Similar MASP curves will be developed for each well in the project depending on their actual top perf and wellbore friction mechanics.

3) Monitoring System to Ensure No Damage is Occurring
Pressure in the water transport pipeline is controlled at the Central Water Plant using automatic control valves. Wellhead injection pressure is then set using a combination of piping configuration, orifice restriction or control valves to avoid injection pressures in excess of the Maximum Allowable Surface Pressure (MASP) prescribed by the DOGGR. Continuous flow rate and pressure monitoring will be accomplished with an electronic data acquisition system. Should individual wellhead injection pressure approach MASP an automatic alarm will activate in the Central Water Plant control room. The operator will then intervene to correct the problem to preclude injection above MASP.

4) Method of Injection
Injection will be conducted through tubing set on a packer just above the zone of injection.

5) Cathodic Protection of Plant, Lines, and Wells
Sections of pipeline in direct contact with the ground will be externally coated. In addition, a Cathodic Protection System using impressed current rectification and/or sacrificial anodes may be installed on the pipeline to avoid external corrosion. Internal corrosion will be controlled by maintaining the water chemistry at low corrosion potentials through addition of corrosion inhibition chemicals and/or occasional pipeline pigging. The use of internal pipeline corrosion coupons will aid in early detection of potential internal corrosion problems.

6) Treatment of Water to be Injected
Water will be separated from the associated oil using a combination of retention time, chemical and heat. The water will then be clarified using induced gas flotation or the like to achieve acceptable injection water quality. Aera Energy will also consider filtration to further clarify the water.

7) Source and Analysis of Injected Liquid
The water for injection is produced water from the Lombardi and Aurignac reservoirs at Aera's San Ardo Field. The water is separated from the associated oil at Aera's Central Tank Battery using fired vessels, residence time in storage tanks, and chemical emulsion breakers. A geochemical analysis of the injection water is attached as Exhibit C7.1. The injection water particle size currently ranges from 5 to 50 microns. The majority of the particulate are FeS. By the time a new line is laid through the existing Hambey waste water disposal project and on south to the proposed disposal site at sections 30/33, the particle size and

number will be greatly improved due to a new pipeline and more frequent line pigging.

8) Location and Depth of Water Source Wells
All injection water will be produced water. According to Monterey County Environmental Health Services (Mr. Matt Fore), there are no known water source wells within ¼ mile of injection area.

D) LETTERS OF NOTIFICATION TO OFFSET OPERATORS
There are no offset operators and no offset wells, so no letters of notification have been prepared.

California Regional Water Quality Control Board
Central Coast Region

Winston H. Hickox
Secretary for
Environmental
Protection

Internet Address: hhttp://www.swrcb.ca.gov/~rwqcb3
81 Higuera Street, Suite 200, San Luis Obispo, California 93401-5427
Phone (805) 549-3147 • FAX (805) 543-0397

Gray Davis
Governor

July 15, 1999

Mr. W. D. Anderson, Manager of Operations
Aera Energy LLC, San Ardo Field
66893 Sargent Road
San Ardo, CA 93450

Dear Mr. Anderson:

AERA ENERGY, SAN ARDO OIL FIELD; PROPOSED CLASS II DEEP INJECTION WELL

We have received a copy of the USEPA Underground Injection Control Aquifer Exemption dated July 12, 1999 (attached). We understand this extension of the exempted area for San Ardo oil field includes the area of your proposed injection wells. This exemption applies to the Aurignac and Continental geologic strata in the specified map areas.

Based on the Central Coast Region Basin Plan and the Sources of Drinking Water Policy, State Water Resources Control Board Resolution No. 88-63, the exemption can be applied to aquifers currently designated municipal or domestic water supply if:

> "The aquifer ... has been exempted administratively pursuant to 40 Code of Federal Regulations, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR , Section 261.3."

Pressures for the injection must be constrained in a way that prevents fracturing or migration of injected fluids outside the Aurignac and Continental geologic strata specified in the USEPA exemption language. We understand regulation of injection pressure is done through the California Division of Oil, Gas and Geothermal Resources.

Therefore, based on the USEPA exemption and your continuing compliance with California Division of Oil, Gas and Geothermal Resources regulations, we approve your application for two Class II deep injection wells (well 811-30 in NW ¼ section 30 and well 831-33 in NW ¼ section 33 both in township 23 south, range 11 east, Mount Diablo Base & Meridian). If you have questions, please call **Lou Blanck at (805) 542-4626**.

Sincerely,

for Roger W. Briggs
Executive Officer

LB: smu2/elb/oilfield/aera/injwell

Attachment: USEPA July 12, 1999 Underground Injection Control Aquifer Exemption

cc:

Ms. Alexis Strauss, Acting Director
Water Division
USEPA Region 9
75 Hawthorne Street
San Francisco, CA 94105-3901

Mr. Al Koller
Division of Oil, Gas and Geothermal Resources
5075 S. Bradley Road, #221
Santa Maria, CA 93455

Mr. Curtis Weeks
Monterey County, Water Resources Agency
893 Blanco Circle
Salinas, CA 93901-4455

Mr. Frank Cummings, P.E.
Manager – Environmental Health Service
Aera Energy LLC
5060 California Avenue
Bakersfield, CA 93309

Mr. Walter Wong
Monterey Co. Environmental Health Dept.
1270 Natividad Road
Salinas, CA 93906